EFFECTS OF ALCOHOL ON LENGTH AND WEIGHT OF YOUNG-OF-THE-YEAR IDE *IDUS IDUS* (L.) AND ROACH *RUTILUS RUTILUS* (L.).

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By

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INTRODUCTION

Shetter (1936) reported the shrinkage of trout on preservation in formalin due to *rigor mortis.* Clutter and Whitesel (1956) and Parker (1963) reported loss in length and weight of fishes preserved in formalin. Lux (1960) stated the average loss in length of yellowtail flounder *(Limanda ferruginea)* between live and landed condition (storage in ice) to be 1.5%.

MATERIAL AND METHODS

Young-of-the-year ide and roach were obtained from the lower reaches of the River Kävlingean south Sweden, by electro-fishing. Live weights and lengths were observed in fish anaesthetized with ethyl m-aminobenzoate (MS. 222). The fish were preserved by dropping them alive in 80% ethanol. Successive changes in lengths were recorded by laying the specimen on plastic-covered millimeter paper, and measured to the nearest milimeter. After the specimens had been wiped with blotting paper weighing was carried out on an electric balance capable of registrating 0.001 g. Weights were recorded to 0.01 g. The samples were then stored in the original preservative in glass containers for the successive observations.

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PRECISION OF WEIGHT MEASUREMENTS

Removal of surface or excess liquid is the most obvious source of error. The procedure of heavy blotting, i.e, laying the fish between folded blotting paper and applying three light pressures, was used for the present study.

Series of consecutive measurements were made to determine the error associated with the blotting procedure. Four young-of-the-year ide were treated as follows: (a) 28 weighings at 1 minute intervals after preservation in 80% ethanol for 48 hours; (b) as in (a) except after 98 days preservation; (c) as in (a) except after 9 months. In (c) the weight appears to be distributed about a mean with no obvious trend. In series (a) and (b) there is a declining trend most probably caused by loss of fluid (Fig. 1).

Variation in the amount of excess moisture removed before weighing undoubtedly contributed to a major portion of the deviations. Absolute error should be partially related to the size of the fish, i. e. increase as a function of the surface area. Expressed as a percentage of weight, the relative error may be expected to decrease as the size of the fish increases (Parker 1963).

CHANGES IN LENGTH AND WEIGHT OF IDE OCCURRING IN ALCOHOL

Two samples of young-of-the-year ide were weighed and measured alive and preserved in 80% ethanol. The first sample (A, n = 18) was taken on 29th. June 1967 and the second (B, n = 25) on 25th. November 1966.

Changes in length and weight during storage in ethanol are presented in Table 1. Relatively large changes occurred and are expressed as a percentage of the live values.

Shortly after they were put in ethanol the fish shortened to about 96% of their original length in sample A and to 98% in the larger fry (sample B). The length continued to diminish slowly to about 95% in the smaller fry, while the larger ones showed no further change.

Changes in weight did not disclose differences between sizes. Relative changes in length were greater in smaller fry than in larger, i. e. in fish that had not completely scaled their bodies (Cala 1971). Fish shrank to 96% and 98% respectively of the original length and to 80% of the original weight in less than two days. Further changes with time were considered insignificant.

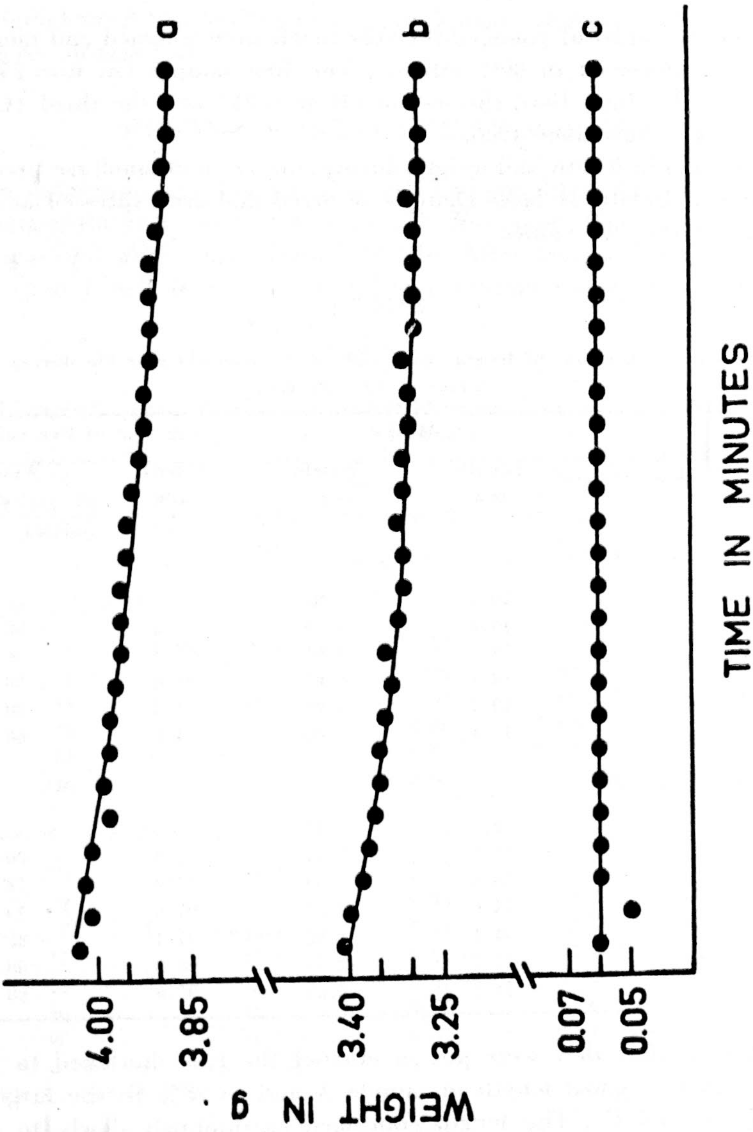

FIGURA Nº 1. Sequencial series of weights taken of alcohol-preserved young-of-the-year ide at I minute intervals.

CHANGES IN LENGTH AND WEIGHT OF ROACH OCCURRING IN ALCOHOL

Three samples of young-of-the-year roach were weighed and measured alive and preserved in 80% ethanol. The first sample (A, n = 25) was taken on 28th. June 1967, the second (B, n = 38) and the third (C, n = 18) on 26th. November 1966.

Changes in length and weight during storage in ethanol are presented in Table 2. Relatively large changes occurred and are expressed as a percentage of the live values.

TABLE 1.

Changes in means of length and weight of young-of-the-year ide during storage in 80% alcohol.

Days in alcohol	Means		Per cent of live value	
	Length mm	Weight g	Length mm	Weight g
Sample A (n = 18)				
0	20.5	0.05	—	—
2	19.6	0.04	95.6	80.0
19	19.5	0.04	94.1	80.0
41	19.4	0.04	94.6	80.0
67	19.3	0.04	94.2	80.0
110	19.4	0.04	94.6	80.0
Sample B (n = 25)				
0	76.3	3.17	—	—
2	74.6	2.54	97.8	80.1
7	76.6	2.50	97.9	78.9
17	74.6	2.53	97.8	79.8
25	74.3	2.55	97.4	80.4
66	74.7	2.54	98.0	80.1
96	74.7	2.55	97.9	80.4

Shortly after they were put in ethanol the fish shortened to about 94% of their original length in sample A and to 98% in the larger fry (sample B and C). The length continued to diminish slowly to about 93% in the smaller fry, while the larger ones showed no further change.

Changes in weight do not disclose large differences between sizes, except sample A (vide Table 2). Generally, the changes are larger in the smaller fry than in the larger ones, like the changes in length. Relative changes in length were greater in smaller fry than in larger, i.e. in fish that had not completely scaled their bodies (Cala 1971). Fish shrank to 94% and 98% respectively of the original length and to 71% and 80% of the original weight in less than two days. Further changes with time were considerer insignificant.

SHRINKAGE DUE TO RIGOR MORTIS

To determine the changes in length and weight during *rigor mortis* 28 young-of-the-year roach, taken on 25th. November 1966, were weighed and measured alive, and allowed to die. After having been kept two hours, spaced well apart, on a metal tray without water, at 4.5° C room

TABLE 2.

Changes in means of length and weight of young-of-the-year roach during storage in 80% alcohol.

Days in alcohol	Means		Per cent of live value	
	Length mm	Weight g	Length mm	Weight g
Sample A (n = 25)				
0	20.8	0.07	—	—
2	19.5	0.05	93.7	71.3
19	19.4	0.05	93.3	71.3
41	19.3	0.05	92.8	71.3
64	19.2	0.05	92.3	71.3
110	19.3	0.05	92.8	71.3
Sample B (n = 38)				
0	46.3	0.72	—	—
2	45.3	0.56	97.8	77.8
7	45.3	0.56	97.8	77.8
17	45.1	0.60	97.4	83.3
25	45.1	0.57	97.4	79.2
66	44.9	0.57	97.0	79.2
96	45.1	0.57	97.4	79.2
Sample C (n = 18)				
0	79.2	4.01	—	—
2	77.7	3.24	98.1	80.8
7	78.0	3.22	98.5	80.3
17	78.1	3.22	98.6	80.3
25	77.8	3.23	98.2	80.5
66	77.4	3.28	97.7	81.8
96	77.8	3.28	98.2	81.8

temperature, they were measured again. The mean total length and weight of the live fish was 45.7 mm and 0.695 g, and of the fish in *rigor mortis*, 45,3 mm and 0,674 g. These figures indicate an average shrinkage of 0.4 mm (0.88%) in length and a loss of weigth of 0,021 g (3%), or shortened to about 99% and to about 97% respectively of the live values.

In order to know any difference in the change in weight and length during *rigor mortis*, with respect to the amount of water surrounding the fish, two samples of young-of-the-year roach were weighed and measured alive. The fishes were allowed to die, as above, in solution of ethil m-aminobenzoate (MS. 222). The two samples (A, n = 24) and (B, n = 25) were taken on 25th. November 1966. After having kept the fishes for 10½ hours, spaced well apart, on a metal tray without water (sample A) and in tapwater (sample B), at room temperature of 4.5° C, they were measured again. The mean total length of the live fish was 50.12 mm and 48.88 mm, and the mean weight was 0.909 g and 0.784 g; and the measurements of the fish, after *rigor mortis* were 49.25 mm, 0.818 g and 48.44 mm, 0.882 g for samples A and B respectively. These figures indicate an average shrinkage of 0.87 mm (1.7%) or about 98% of the live length for sample A, and 0.44 mm (0.8%) or about 99% of the live length for sample B. Further, a loss of weight occurred of 0.091 g (9.9%) or about 90% of the live weight for sample A, while the fish kept in freshwater (sample B) showed a gain of 0.098 g (13%) or about 113% of the live weight.

DISCUSSION

The problem of gain or loss in weight is one of osmotic exchange of water and the amount of initial change (excluding the size effect) may largely depend upon the state of osmoregulation or amount of body water at the time of original measurement (Parker 1963).

With the sources of error noted and the established variable effects of preservative solutions, it is difficult to evaluate many of the studies on condition factor reported in the literature. Such terms as "live weight" or "fresh condition" are not sufficiently descriptive to establish the degree of water uptake at the time of weighing. A freswater fish which has been captive in a gill-net for 12 hours may be in fresh condition but 120% of its live weight (Parker 1963). Weights of fish kept in water with insufficient oxygen (Parker 1963) or kept in or out water after death until weighing may not be equivalent to the live weights or even a constant percentage of live weights.

In the present study a size effect has been noted which alters not only the relative amount but also the rate of water exchange according to the amount of water in contact with the fish. A loss of weight occurred of 0.091 g (9.9%, n = 24) or about 90% of the live weight for fish kept without water, while fish kept in freshwater showed a gain of 0.098 g (13%, n = 25) or about 113% of the live weight. The fishes were mantained after death for 10½ hours at 4.5° C room temperature.

SUMMARY

Changes in length were recorded by sequential measurements of fish killed and stored in 80% ethanol. Young-of-the-year ide shrank to 96% (sample A) and to 98% (sample B) of original length in less than 24 hours (Table 1), and subsequently the smaller fry, shrank to about 95% while the larger ones showed no further change.

Young-of-the-year roach shrank to 94% (sample A) and to 98% (samples B and C) of original length in less than 24 hours (Table 2). Subsequently the smaller fry (sample A) shrank to about 93%, those in sample B shrank to about 97%, while the larger ones (sample C) showed no further change.

The proportionate changes in weight among fishes of different sizes varied very little. Young-of-the-year ide and roach (Table 1 and 2) diminished to about 80% of their original weigth in less than two days. Further changes with time were considered insignificant, except in sample A in Table 2.

The apparent different loss of weight in ide (sample A, Table 1) and in roach (sample A, Table 2) could be due to some systematic error during measurements, because the age and length of the fish of the two samples were more or less the same.

Changes in length and weight were recorded during anaesthesia and after the death of fishes kept in water and without it. It was concluded that, for fish under anaesthesia, weight must be observed as soon as voluntary movement ceases in order to approximate the live weight. Prolonged anaesthesia (although respiratory movement may continue) and death affect osmoregulation. Fish kept in freshwater after death gain weight and shrink less in comparison with fish kept out of water, which lose weight.

In accordance with Parker (1963) it can be concluded that no standard correction terms would be generally usable. Correction terms would have to be determined for each study taking into account the original state and size of fish, type and ionic concentration of the preservative and the length of time during which the fish is stored in it. Thus, the correction factor can be different, for instance, even for the same species, for those who consider the factor *rigor mortis* and for those who do not.

RESUMEN

Cambios en la longitud fueron observados mediante subsecuentes medidas de peces sacrificados y almacenados en alcohol al 80%. Alevinos *Idus idus* (L.) disminuyeron su longitud original a 96% (muestra A) y a 98% (muestra B) en menos de 24 horas (Tabla 1), y subsecuentemente los alevinos muy pequeños, se encogieron hasta *ca.* de 95% mientras los más largos no mostraron cambios posteriores.

Alevinos *Rutilus rutilus* (L.) disminuyeron su longitud original a 94% (muestra A) y a 98% (muestras B y C) en menos de 24 horas (Tabla 1). Subsecuentemente, los alevinos muy pequeños (muestra A) disminuyeron su longitud hasta *ca.* de 93%, los de la muestra B hasta *ca.* de 97%, mientras que los más largos (muestra C) no mostraron cambios posteriores.

Los cambios proporcionados en peso entre los peces de diferente tamaño varían muy poco. Alevinos *L. idus* y *R. rutilus* (Tablas 1 y 2) disminuyeron hasta *ca.* de 80% de su peso original en menos de 2 días. Cambios posteriores, en peso, con el tiempo fueron considerados insignificantes, excepto en la muestra A (Tabla 2).

La diferente pérdida aparente de peso de *L. idus* (muestra A, Tabla 1) y de *R. rutilus* (muestra A, Tabla 2) puede ser debido a algún error sistemático durante las mediciones, ya que las edades y longitudes de los peces de las dos muestras eran más o menos las mismas.

Cambios de longitud y peso de los peces fueron registrados tanto durante anestesia como después de muertos y mantenidos en agua o en seco. Se concluyó que en los peces puestos bajo anestesia, el peso debe ser observado tan pronto como cese el movimiento voluntario para así poder aproximarse al peso en vivo. Anestesia prolongada (aunque los movimientos respiratorios puedan continuar) y la muerte afectan la osmorregulación. Los peces mantenidos en agua dulce después de la muerte ganan peso y se encogen menos en comparación con los peces mantenidos en seco, los cuales pierden peso.

De acuerdo con Parker (1963), puede concluírse que factores *standards* de corrección no son generalmente usuales. Los factores de corrección habrán de ser determinados para cada estudio tomando en cuenta el estado original y el tamaño del pez, tipo y concentración iónica del preservativo y el tiempo que el pez es almacenado en él. Así, el factor de corrección puede ser diferente, por ejemplo, inclusive para la misma especie, para quienes consideren el factor *rigor mortis* y para aquellos que no lo consideren.

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